STUDY OF BIOLOGICAL EFFECTS AND OXIDATIVE STRESS RELATED RESPONSES IN GAMMA IRRADIATED ARABIDOPSIS THALIANA PLANTS

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Besides various natural sources of ionizing radiation in the environment such as the presence of primordial radionuclides, cosmogenic radionuclides and cosmic radiation, anthropogenic activities such as discharges from nuclear power plants and radioactive waste storage, but more importantly nuclear accidents and weapon testing, can cause an enhancement of the environmental radiation dose. On international level there is imminent legislation for the environmental protection against ionizing radiation and the presence of radionuclides. To protect the environment against the negative effects of ionizing radiation, it is important to study the effects and unravel the mechanisms by which organisms, including plants, respond to gamma radiation.

This study aimed to investigate biological effects in *Arabidopsis thaliana* leaves and roots after irradiation for 72 h with 3.5 Gy or 30 Gy of gamma radiation and to unravel oxidative stress related responses to achieve a better understanding of the importance of the cellular redox balance as a modulator in gamma radiation stress. For this purpose, several endpoints such as growth, nutrient profile, lipid peroxidation, antioxidative enzyme capacities and gene expression for reactive oxygen species (ROS)-producing and -scavenging enzymes were analyzed.

Results indicate that *Arabidopsis thaliana* seems to be a rather radioresistant plant species as no alterations on growth and only minor alterations on the nutrient profile and the antioxidative defense system were observed after irradiation with a total gamma radiation dose of 3.5 or 30 Gy applied over a 3 days period. In contrast to these results, we expected to see a reduction in growth because the lowest total dose of 3.5 Gy was chosen based on a previous experiment inducing a 30 % plant growth reduction after 7 weeks exposure to the same total dose. The reason why we did not see a reduction in growth lies probably in the difference between acute and chronic exposure. A high dose can be applied acute without seeing effects while a lower dose already induces effects when applied chronically. Although an early oxidative burst is an important response mechanism under other stress situations, irradiation with gamma radiation appeared not to induce an NADPH-mediated ROS-production. Lipid peroxidation seemed to be directly induced by ionizing radiation and not mediated through lipoxygenase activity. As ionizing radiation can also cause indirect damage via water radiolysis, hydrogen peroxide is hypothesized an important ROS present under ionizing radiation stress. Although most hydrogen peroxide scavenging enzymes remained unaltered, an important role for catalase was indicated as important alterations were observed on transcriptional level for 3 catalase isoforms suggesting an important role for peroxisomes in the sensing of and response against gamma radiation stress.